

Four New *Sonorella* (Gastropoda: Pulmonata: Helminthoglyptidae) from Northwestern Sonora, Mexico

by

EDNA NARANJO-GARCIA

Department of Ecology and Evolutionary Biology, University of Arizona,
Tucson, Arizona 85721, U.S.A.

Abstract. Four new species of *Sonorella*, three from the Sierra el Viejo and one from the Sierra Pico, Sonora, Mexico, are described. The Sierra Pico is currently the southwesternmost known locality for this genus. Relationships with Arizona species are discussed. *Sonorella ambigua verdensis* Pilsbry, 1939, is elevated to specific status.

INTRODUCTION

In February 1980, several land snail shells were found scattered among rocks in the Sierra el Viejo in northwestern Sonora. Dissection of one adult animal revealed that it was a new species of *Sonorella*, with a verge unlike that of any other known species.

In November 1980, live adults were taken from the limestone outcrops in the same general locality but farther northwest, ca. 2.5 km airline distance from the first location. Dissection of these specimens, however, revealed an entirely different and distinctive verge, even though the shells were not distinguishable from those collected in February. Another field party to the Sierra el Viejo in November 1981 explored a large area of the central deep canyon that runs westerly from the main north-south ridge and additional specimens of the second species were found. This party then explored another range of mountains, the Sierra Pico, just south of the Sierra el Viejo, where still another new species of *Sonorella* was found.

During October 1984, another exploration in the northern part of the range located live adults which, upon dissection, proved to be a fourth new species. The four new species are described below.

The habitat of these four new species of *Sonorella* is within the Lower Colorado River Valley subdivision of the Sonoran Desert according to the criteria of biotic communities of TURNER & BROWN (1982:190). This subdivision is the driest of the Sonoran Desert owing to a combination of low precipitation, high temperature, and low elevation in most of the area. The principal vegetation

includes: Saguaro (*Carnegiea gigantea*), Palo Verde (*Cercidium microphyllum*), Cat Claw Acacia (*Acacia greggii*), Elephant Tree (*Bursera microphylla*), Ironwood (*Olneya tesota*), Creosote Bush (*Larrea tridentata*), Brittle Bush (*Encelia farinosa*), Senita (*Lophocereus schottii*), Organ Pipe Cactus (*Stenocereus thurberi*), Ocotillo (*Fouquieria splendens*), Teddy Bear Cholla (*Opuntia bigelovii*), Desert Lavender (*Hyptis emoryi*), Shrubby Spurge (*Euphorbia misera*), and Palo de Asta (*Cordia parvifolia*).

DESCRIPTIONS

Family HELMINTHOGLYPTIDAE Pilsbry, 1939

Genus *Sonorella* Pilsbry, 1900

Sonorella burgessi Naranjo-Garcia, sp. nov.

(Figures 1, 2)

Description of shell of holotype: Shell depressed, heliciform, glossy, light tan, with a narrow light brown spiral band on rounded shoulder; umbilicate, the umbilicus contained 5.8 times in the diameter of the shell, slightly covered by the reflected columellar lip. Embryonic shell of 1¼ whorls, lustrous; apex with extremely fine growth lines, and with post-apical surface roughened by closely spaced radial wrinkles. Post-embryonic whorls shiny lustrous, marked by light growth wrinkles. The last ½ of the body whorl descends sharply from the shoulder of the penultimate whorl. Aperture oblique, rounded, with peristome slightly expanded; margins converging; parietal callus thick;

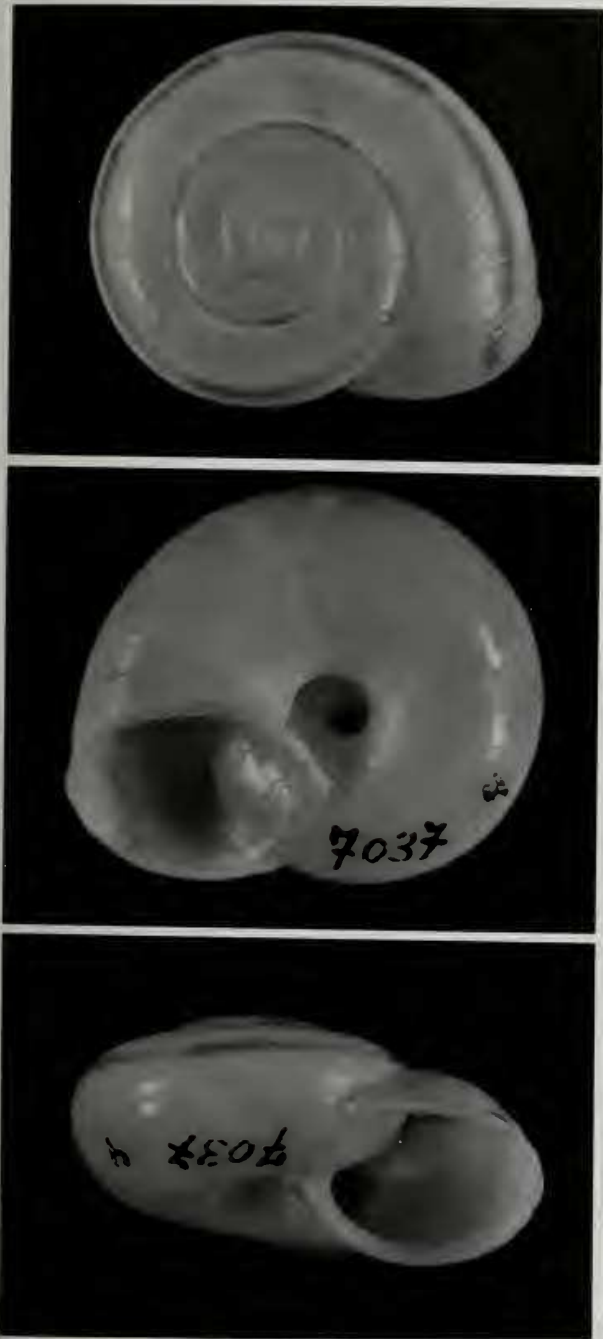


Figure 1

Sonorella burgessi Naranjo-Garcia, sp. nov. Shell of holotype, SBMNH 34933. Apical view, top; umbilicus, middle; aperture, bottom.

inner lip partly covering umbilicus. Shell measurements: diameter 19.6 mm, height 9.6 mm, umbilicus 3.4 mm; whorls, 4 (Figure 1).

Reproductive anatomy of holotype: Apical organs typical of the genus. Male structures exhibit diagnostic char-

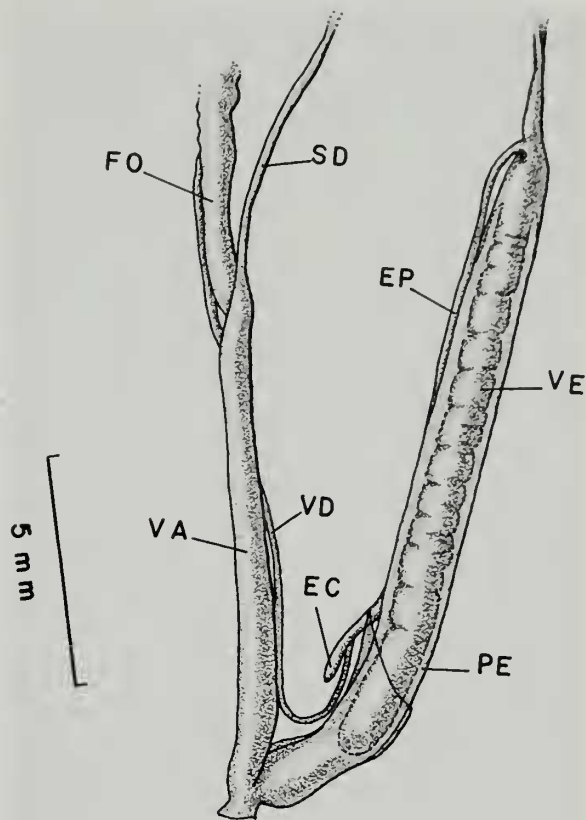


Figure 2

Sonorella burgessi. Lower reproductive anatomy of holotype, SBMNH 34933. EC, epiphallic caecum; EP, epiphallus; FO, free oviduct; PE, penis; SD, spermathecal duct; VA, vagina; VD, vas deferens; VE, verge.

acters as follows: penis long, containing a long, stout, cylindrical verge; verge moderately corrugated, accordion-like, with a parabolic tip, not at all expanded; seminal duct opening terminally; penial sheath enveloping the proximal 4.3 mm of the penis; a distinct, minuscule epiphallic caecum lying free from the vas deferens. Vagina a slender cylinder, scarcely wider at base than at apical region (close to free oviduct). Measurements as follows: penis 15.9 mm, verge 12.4 mm, epiphallic caecum 1.0 mm, vagina 10.0 mm (Figure 2).

Type locality: Sierra el Viejo, Sonora, Mexico, at base of NE-facing limestone cliffs, on ridge SW of canyon junction where road from W turns N; elevation ca. 2100 ft (640 m); 30°19'N, 112°20'W; ca. 7 km E of El Plomito. Collector: T. L. Burgess, 20 February 1980.

Variations in paratypes: Ten paratypes were obtained, all of them only shells, the smallest measuring 17.5 mm in diameter and the largest measuring 20.4 mm. All exhibited the sculpture characteristic of the holotype.

Disposition of types: Holotype: Santa Barbara Museum of Natural History No. SBMNH 34933. Paratypes: Wal-

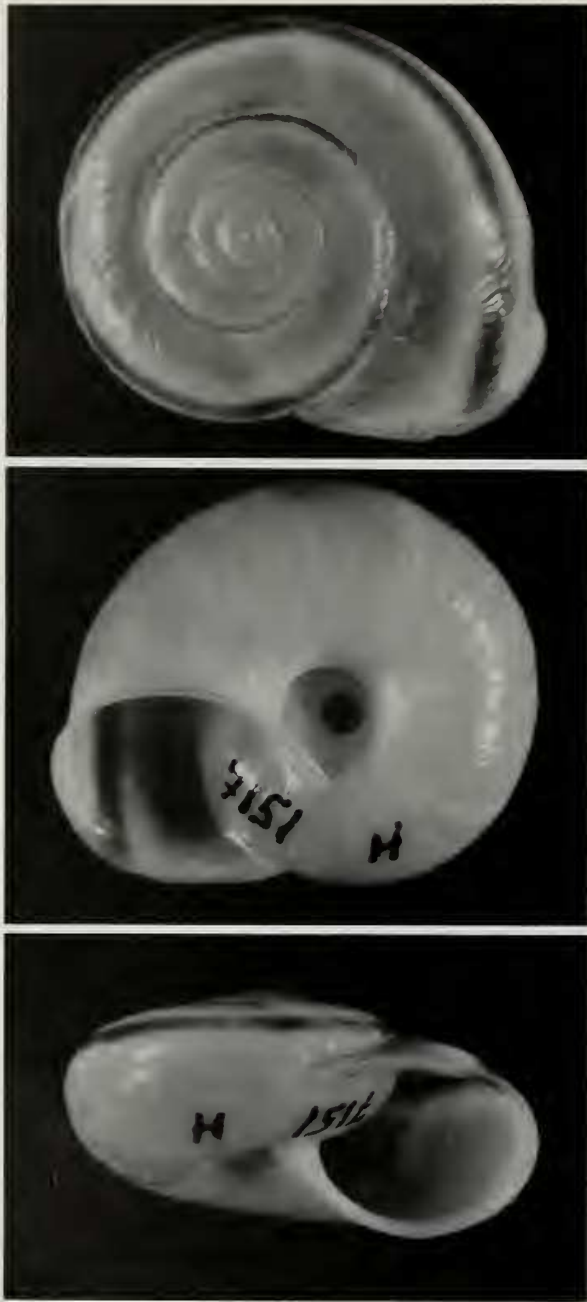


Figure 3

Sonorella pratti Naranjo-Garcia, sp. nov. Shell of holotype, SBMNH 34936. Apical view, top; umbilicus, middle; aperture, bottom.

ter B. Miller collection No. 7037, E. Naranjo-Garcia collection No. 378.

Etymology: This species is named after T. L. Burgess, the biologist who found the first specimen and brought it back for identification.

Sonorella pratti Naranjo-Garcia, sp. nov.

(Figures 3, 4)

Description of shell of holotype: Shell depressed, helical, light brown, with chestnut spiral band on well rounded shoulder; umbilicate, umbilicus contained 4.8 times in diameter of shell. Aperture barely covered by the reflected columellar lip. Embryonic shell of $1\frac{1}{4}$ whorls marked by microscopic, hyphen-shaped papillae, arranged in parallel spirals on top of the closely spaced radial wrinkles at the outer half of the whorl; body whorl with faint, parallel, spiral grooves impressed on its upper surface; parietal callus thin. Shell measurements: diameter 19.3 mm, height 9.7 mm, umbilicus 4.0 mm; whorls, $4\frac{1}{4}$ (Figure 3).

Reproductive anatomy of holotype: Ootestis and female structures as in other *Sonorella*. Diagnostic characters of male structures: penis long, containing a long, stout, club-shaped, cylindrical, smooth verge having an enlarged broadly conic, invaginable tip; penial sheath encasing the proximal 4 mm of the penis. Epiphallus shorter than penis; epiphallial caecum minute ca. 1.3 mm, buried in the connective tissue of the vas deferens. Vagina ca. half the length of penis, cylindrical, barely tapering to the gonopore. Measurements as follows: penis 22.0 mm, verge 17.5 mm, vagina 11.5 mm (Figure 4).

Type locality: Sierra el Viejo, Sonora, Mexico, in north facing limestone rockpiles, at base of cliffs, at mouth of large, central canyon, running westerly, at point 9.5 road miles (15.2 km) north and 4.5 road miles (7.2 km) east of El Plomito; $30^{\circ}20'N$, $112^{\circ}20.8'W$; elevation ca. 1650 ft (500 m). Type lot collected by W. B. Miller, W. L. Pratt, and University of Arizona Bio. 580 students, 21–22 November 1980.

Variations in paratypes: Twenty-eight paratypes were obtained, the largest specimen measuring 21.3 mm in diameter and the smallest measuring 17.7 mm. All but two of the unworn shells exhibited the characteristic sculpture of the holotype; the two exceptions had no papillae on the embryonic shell and no spiral grooves on the body whorl. Twelve dissections were made, and all showed the typical large, stout, club-shaped verge; some had the tip in varying stages of invagination.

Disposition of types: Holotype: Santa Barbara Museum of Natural History No. SBMNH 34936. Paratypes: National Museum of Natural History, Smithsonian Institution No. USNM 859304, Academy of Natural Sciences of Philadelphia No. ANSP 367154, Field Museum of Natural History No. FMNH 205920, University of Texas at El Paso No. 10389, Universidad Nacional Autónoma de México Colección Malacológica No. 1207, Walter B. Miller collection No. 7151.

Etymology: This species is named after my colleague Dr. William L. Pratt.

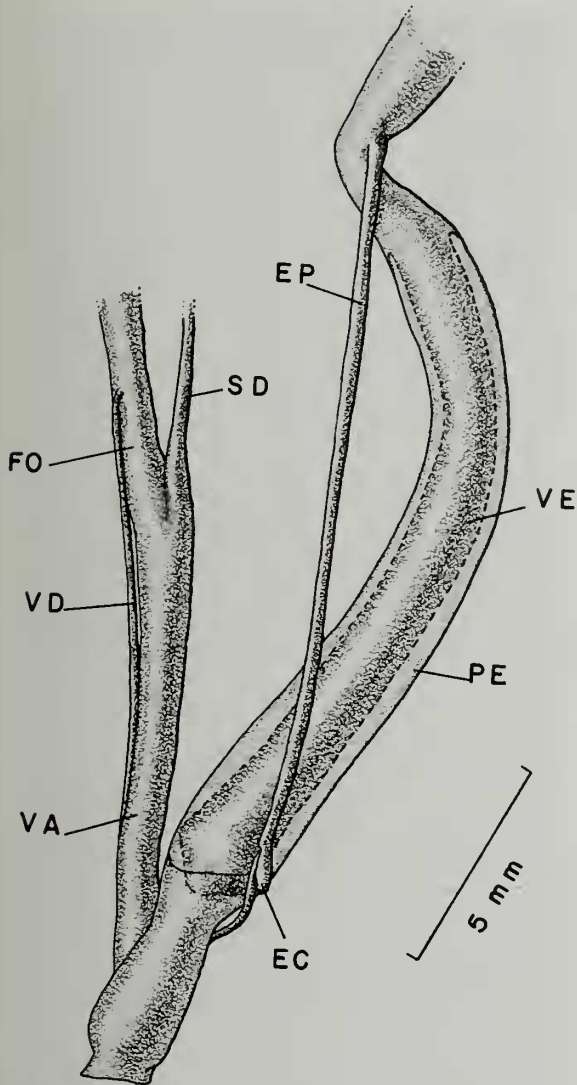


Figure 4

Sonorella pratti. Lower reproductive anatomy of holotype, SBMNH 34936. EC, epiphallic caecum; EP, epiphallus; FO, free oviduct; PE, penis; SD, spermathecal duct; VA, vagina; VD, vas deferens; VE, verge.

Sonorella rothi Naranjo-Garcia, sp. nov.

(Figures 5, 6)

Description of shell of holotype: Shell depressed, globose, light tan, with a light brown spiral stripe on shoulder; shoulder round. Umbilicate, umbilicus contained 5.8 times in shell diameter. Embryonic shell of 1¼ whorls, apex with fine growth lines, thereafter the entire surface marked by numerous, closely spaced, hyphen-shaped papillae arranged in parallel, descending spirals; traces of a few scattered round papillae on subsequent whorls; shallow, parallel spiral grooves present on the last fourth of the body whorl near the suture; parietal callus very thin. Shell mea-



Figure 5

Sonorella rothi Naranjo-Garcia, sp. nov. Shell of holotype, SBMNH 34934. Apical view, top; umbilicus, middle; aperture, bottom.

surements: diameter 20.3 mm, height 11.9 mm, umbilicus 3.5 mm; whorls, 4⅓ (Figure 5).

Reproductive anatomy of holotype: Ototestis and female structures as in other *Sonorella*. The male structures exhibit diagnostic characters as follows: penis long, con-

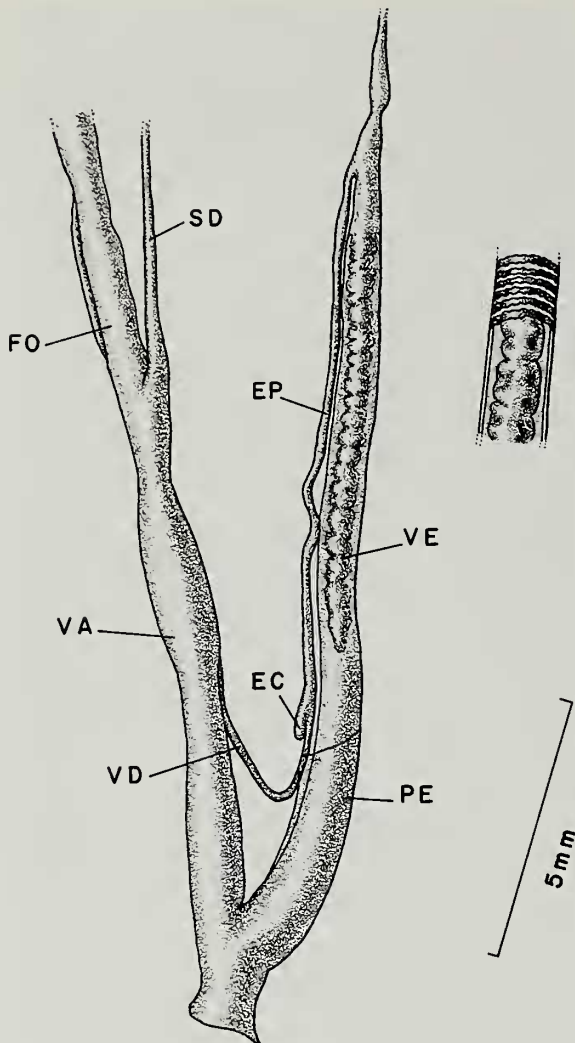


Figure 6

Sonorella rothi. Lower reproductive anatomy of holotype, SBMNH 34934. EC, epiphallic caecum; EP, epiphallus; FO, free oviduct; PE, penis; SD, spermathecal duct; VA, vagina; VD, vas deferens; VE, verge.

taining a thin, corrugated and dimpled verge, with an acutely pointed tip. The upper $\frac{2}{3}$ of inner walls of penis glandular. Penial sheath $\frac{1}{3}$ as long as the penis; small epiphallic caecum lying free from the vas deferens. Vagina almost cylindrical, the upper region widening ovally, the middle narrowing slightly and the region close to the gonopore widening again; the inner walls are glandular (Figure 6). Measurements: penis 14.7 mm, verge 7.9 mm, penial sheath 4.6 mm, epiphallic caecum 0.7 mm, vagina 10.2 mm.

Type locality: NW end of Sierra Pico (not "Picu"; see OFFICE OF GEOGRAPHY, 1956:467), Sonora, Mexico, in igneous rocks at base of cliffs, along road from El Plomito to Puerto Libertad, at 14.9 road miles (23.8 km) from El

Plomito; elevation ca. 1200 ft (365 m); 30°0.5'N, 112°27'W. Type material collected by W. B. Miller, B. Roth, and J. E. Hoffman, 13 November 1981.

Variations in paratypes: Five live specimens and 25 shells were collected in the type lot, the largest shell measuring 21.7 mm in diameter and the smallest measuring 18.5 mm. The unworn shells exhibited the characteristic sculpture of the holotype in various degrees. Only two of the live specimens were adult, and their dissection revealed a similar thin, corrugated, dimpled, sharply pointed verge.

Disposition of types: Holotype: Santa Barbara Museum of Natural History No. SBMNH 34934. Paratypes: National Museum of Natural History, Smithsonian Institution No. USNM 859305, Academy of Natural Sciences of Philadelphia No. ANSP 367153, Field Museum of Natural History No. FMNH 205921, University of Texas at El Paso No. UTEP 10390, Universidad Nacional Autónoma de México Colección Malacológica No. 1208, Walter B. Miller collection No. 7242, E. Naranjo-García collection No. 374.

Etymology: This species is named after my friend and colleague Dr. Barry Roth.

Sonorella seri Naranjo-García, sp. nov.

(Figures 7, 8)

Description of shell of holotype: Shell depressed, heliciform, light brown with a narrow chestnut band on the shoulder. Umbilicate, umbilicus contained 4.7 times in shell diameter. Embryonic shell of $1\frac{1}{4}$ whorls, apex smooth; first half of post-apical embryonic whorls with well defined growth wrinkles gradually covered by punctate papilla; the second half with hyphen-like papillae producing a reticulate effect; reticulation disappearing gradually on later whorls, leaving only growth wrinkles and a shiny periostracum; parietal callus thin. Shell measurements: diameter 18.9 mm, height 8.9 mm, umbilicus 4.0 mm; whorls, 4 (Figure 7).

Reproductive anatomy of holotype: Ototestis and female structures as in other *Sonorella*. Penis long, containing a long, smooth verge slightly wider near the end, terminating in attenuated tip. Penial sheath short, less than $\frac{1}{2}$ the length of the penis. Epiphallis shorter than penis, epiphallic caecum minute, ca. 1.0 mm. Vagina tubular, slightly tapering to the gonopore; inner walls glandular, length ca. $\frac{1}{2}$ as long as the penis. Measurements as follows: penis 23.7 mm, verge 21.1 mm, penial sheath 5.0 mm, vagina 12.6 mm (Figure 8).

Type locality: Sierra el Viejo, Sonora, Mexico, in N-facing limestone piles at north end of range, 30°24.1'N, 112°22.5'W, elevation ca. 1800 ft (550 m). Type specimens collected by W. B. Miller, J. E. Hoffman, G. Fink, and E. Naranjo-García, 20 October 1984.

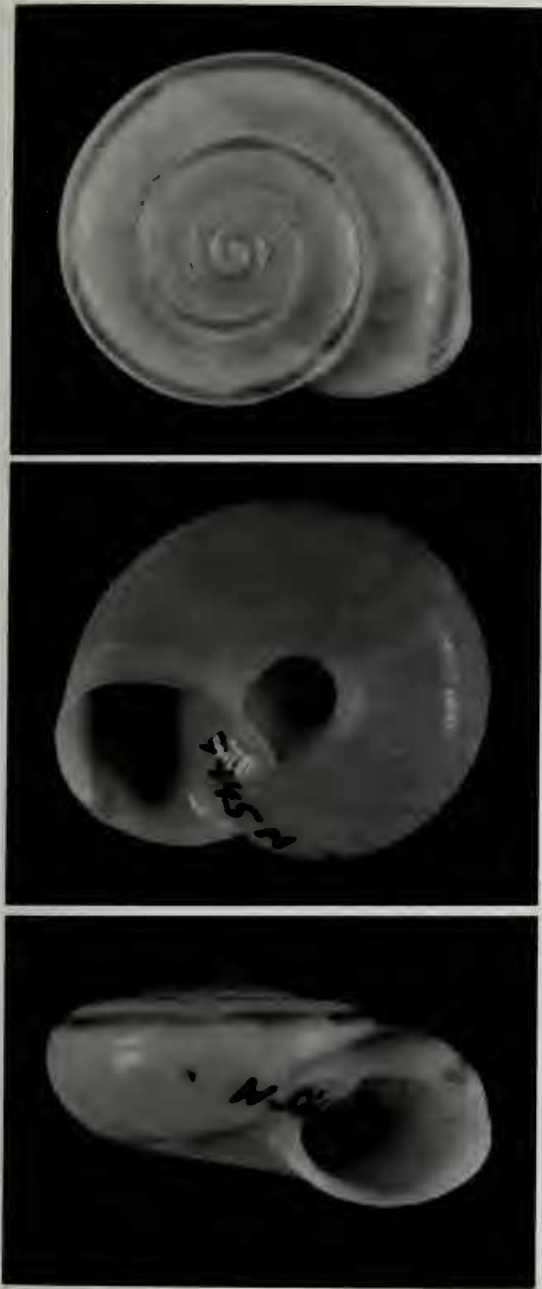


Figure 7

Sonorella seri Naranjo-Garcia, sp. nov. Shell of holotype, SBMNH 34935. Apical view, top; umbilicus, middle; aperture, bottom.

Variations in paratypes: Thirty-five paratypes were obtained, including some live ones, the smallest measuring 16.0 mm in diameter and the largest measuring 19.6 mm. The fresh, unworn shells exhibited a sculpture similar to that of the holotype.

Disposition of types: Holotype: Santa Barbara Museum of Natural History No. SBMNH 34935. Paratypes: National Museum of Natural History, Smithsonian Insti-

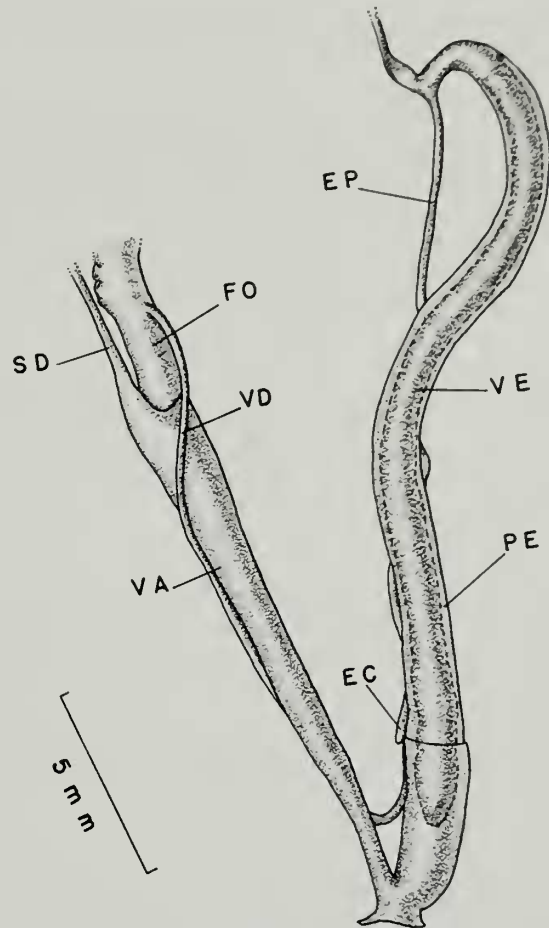


Figure 8

Sonorella seri. Lower reproductive anatomy of holotype, SBMNH 34935. (Composite drawing based on holotype and one other specimen, because in the holotype the female side is folded.) EC, epiphallal caecum; EP, epiphallus; FO, free oviduct; PE, penis; SD, spermathecal duct; VA, vagina; VD, vas deferens; VE, verge.

tution No. USNM 859306, Academy of Natural Sciences of Philadelphia No. ANSP 367155, Field Museum of Natural History No. FMNH 205922, University of Texas at El Paso No. UTEP 10391, Universidad Nacional Autónoma de México Colección Malacológica No. 1209, E. Naranjo-Garcia collection No. 405, Walter B. Miller collection No. 7445.

Etymology: This species is named for the natives living in the vicinity of the type locality, the Seri People.

DISCUSSION

The shells of *Sonorella burgessi*, *S. pratti*, *S. rothi*, and *S. seri* are essentially similar in appearance and, although there are distinguishable differences in the sculpture of fresh, unworn shells, the range of variation in the number of embryonic papillae and in the degree of faintness or prominence of body-whorl spiral grooves renders these

diagnostic characters unreliable. The size and shape of the verge, however, provide an immediate, unequivocal diagnosis.

Sonorella burgessi is probably most closely related to *Sonorella ambigua* Pilsbry & Ferriss, 1915, and *Sonorella verdensis* Pilsbry, 1939, here elevated to specific status. In 1967 MILLER ranked *S. verdensis* as a subspecies of *S. ambigua* because the verge of these two species looked very much alike. However, the verge of *S. verdensis* is more than one-third longer than that of *S. ambigua*. Furthermore these two taxa are geographically separated by over 160 km, without intervening populations. Accordingly, they are considered to be reproductively isolated.

The male reproductive anatomy of *Sonorella burgessi* shows an almost cylindrical verge, smooth, with some foldings, and a well rounded tip, while *S. ambigua* has a club-shaped verge, corrugated the last third of its length, with the thickest part behind the broad tip. In *S. verdensis* the shape of the reproductive structures is about the same as that of *S. ambigua*; however, the dimensions are ca. one-third larger. The length of the structures is the shortest in *S. burgessi*. The vagina is almost cylindrical, tapering slightly to its apical end; in *S. ambigua* and *S. verdensis* the vagina is cylindrical.

The reproductive anatomy of *Sonorella pratti* resembles that of *Sonorella imitator* Gregg & Miller, 1972. The differences between them are: the shell of *S. imitator* is heavier and darker in color, and it has a taller spire; as a consequence the shell is more globose-helicoid than in *S. pratti*, which is flatter. The apical sculpture possesses round papillae on top of the strong growth wrinkles; subsequent whorls bear fine stippling except on the body whorl. The shell of *S. pratti* is light, and light tan in color, and the shape is depressed-helicoid. The growth wrinkles are fine as are the spiral descending threads; subsequent whorls are smooth. In the reproductive system the main differences are in the vagina of *S. imitator* which is about the same size as the verge (one-eighth shorter), while in *S. pratti* it is one-half the length of the verge. The free oviduct and the penis in *S. imitator* are shorter than in *S. pratti*.

Sonorella rothi has a verge somewhat similar in shape to those of *Sonorella ashmuni* Bartsch, 1904, and *Sonorella sabinoensis sabinoensis* Pilsbry & Ferriss, 1919, but with significant differences in proportions. In *S. s. sabinoensis* the length of the verge is more than two-thirds the length of the penis whereas in *S. rothi* and *S. ashmuni* it is only about one-half the length of the penis. There are also significant differences in the proportional sizes and shapes of the vagina. In *S. s. sabinoensis* and *S. ashmuni*, it is

cylindrical and as long as the penis; in *S. rothi*, it forms an oval node at its apical end and it is less than two-thirds the length of the penis.

Sonorella seri seems to be most closely related to *Sonorella parva* Pilsbry, 1905, and *Sonorella virilis virilis* Pilsbry, 1905. The shape of the verge is similar in these three species. The length of the penis of *S. seri* is about equal to that of *S. parva*, but shorter than that of *S. v. virilis*; the vagina equals the length of the penis in *S. parva*, while in *S. seri* it is about one-half, and in *S. v. virilis* it is about two-thirds the length of the penis. The shape of the vagina is different in all three species. In *S. seri* it is a narrow cylinder that tapers to the basal end, in *S. parva* a cylinder with a swollen node near the middle, and in *S. v. virilis* a long cylindrical tube without node or tapering end.

From these explorations in northwestern Sonora it can now be stated that the southwesternmost limit of the genus *Sonorella* lies in the Sierra Pico, although it is possible that it might extend a few kilometers to the west where similar physical and biotic conditions exist but no explorations have yet been made. Beyond the Sierra de Aguirre the situation changes abruptly and a different habitat reveals populations of *Eremarionta rowelli mexicana* (Pilsbry & Lowe, 1934). No species of *Eremarionta* has ever been found sympatrically with species of *Sonorella* (BEQUAERT & MILLER, 1973).

ACKNOWLEDGMENTS

I wish to thank Walter B. Miller, who collected and dissected many of the specimens and provided me with the material from his early trips to the Sierra el Viejo area and Arizona. I am grateful to W. B. Miller and Jim Hoffman for their companionship in the field. R. Sidner helped revise the manuscript. Consejo Nacional de Ciencia y Tecnologia provided grant support for my studies.

LITERATURE CITED

- BEQUAERT, J. C. & W. B. MILLER. 1973. The mollusks of the arid southwest with an Arizona check list. University of Arizona Press: Tucson, Arizona. 271 pp.
- MILLER, W. B. 1967. Anatomical revision of the genus *Sonorella* (Pulmonata: Helminthoglyptidae). Ph.D. Dissertation, University of Arizona. 293 pp., illus., maps.
- OFFICE OF GEOGRAPHY (Dept. of Interior). 1956. Mexico: official standard names. Washington, D.C. 750 pp.
- TURNER, R. M. & D. E. BROWN. 1982. Sonoran deserts scrub. In: D. E. Brown (ed.), Biotic communities of the American southwest—United States and Mexico. Desert plants (special issue). Vol. 4(1-4):190-200.